relationships could be identified by examining habitat characteristics in density areas identified by the aerial survey.

The distribution maps provided in this report are ARC/INFO coverages and are fully compatible with the Division of Realty's APS model and the refuge's ARC/INFO system. The information can be used immediately for land management decisions. While we are confident the quality of the distribution information is very high, it still is based on only one year of data. For an area as important to waterfowl as the Yukon Flats, it would be prudent to acquire 1 to 2 more years of comparable distribution data to ensure the quality of baseline information used for impact assessment.

Duck production surveys

The major objective of the duck production survey was to gain a better understanding of the brood distribution in the DPS. We believe that a sample size of 90 or more systematically placed plots was needed to provide good brood distribution information from an area the size of the DPS. Such an effort was not economically feasible. Our approach was to select 90 plots and survey a subset of 30 plots in 1991. The remaining plots could be surveyed in successive years.

The 30 systematically placed plots provided information on the distribution of broods (Fig. 13). Few diver broods were observed. The frequency distribution by age class indicated Class 1 dabbler broods were highest followed by Class 2 and 3. The few diver broods observed were all Class 1. These data indicate the survey was early even for dabblers.

We anticipated that a comparison of our results with those of the refuge duck production survey (Hodges 1991) would help evaluate the relative merits of sampling small systematically placed plots by helicopter versus larger random plots surveyed primarily from the ground. The surveys could not be conducted at the same time thus, the utility of comparison was reduced. However, some useful points can be made.

Systematic placement of plots generally provides better distribution data than random placement. A systematic design with a higher sample size is more likely to sample habitats representatively than a random design with fewer samples. One of the helicopter plots had no waterbodies at all. No broods were seen on nine (30%) of the helicopter plots in 1991. No broods were seen on only 1 of the 20 random plots surveyed by the refuge. This suggests that the smaller random sample may have underrepresented low density areas.

Lensink (1965) suggested that smaller plots would result in higher variance estimates. The coefficients of variation from

the helicopter plots (Table 6) and the refuge plots (Hodges 1991) were very similar. This indicates that a larger sample of smaller plots may yield comparable variance estimates.

SUMMARY

The Division of Migratory Birds was asked by the Division of Realty and Refuges and Wildlife to provide one year of baseline waterfowl data for use in the assessment of future oil exploration and development on the Yukon Flats National Wildlife Refuge. We believe that the aerial survey data presented in this report provide useful information for impact assessment, land management decisions, and survey design and evaluation. We are committed to providing waterfowl information that is not only useful at the national and state level but at the refuge level. The data presented in the report is intended to illustrate the kind of information we can provide and ways in which it can be used. All the distribution maps presented are compatible with Service computer applications. We would like to work with the Division of Realty and refuge staff to maximize the utility of the information provided.

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Literature Cited

COCHRAN, W. G. 1977. Sampling Techniques. Third edition. John Wiley and Sons, Inc, New York, N.Y. 428pp.

CONANT, B., AND C. P. DAU. 1991. Alaska - Yukon waterfowl breeding population survey. Unpub. Report. U.S. Fish and Wildlife Service, Juneau, AK

CONANT, B., J. I. HODGES, W. LARNED, AND L. S. MCLEAN. 1988. Yukon Flats Alaska Helicopter/fixed wing comparative waterfowl breeding population survey. Unpub. Progress Report III. U.S. Fish and Wildlife Service, Juneau, AK

GRAND, J. B., AND D. ESLER. 1990. Breeding ecology of northern pintail ducks on the Yukon Flats, Alaska. Annual Report, U.S. Fish and Wildlife Service, Anchorage, AK

HEGLUND, P. J. 1988. Relations between waterbird use and the limnological characteristics of wetlands on Yukon Flats National Wildlife Refuge, Alaska. M.S. Thesis. Univ. of Missouri, Columbia, MO 179pp.

HODGES, J. I. 1990. Expanded Breeding Pair Survey - Yukon Flats Unpub. Progress Report. U.S. Fish and Wildlife Service, Juneau, AK

HODGES, J. I. 1991. Alaska Waterfowl Production Surveys. Unpub. Progress Report. U.S. Fish and Wildlife Service, Juneau, AK

————, AND B. CONANT. 1990. Alaska Duck Production Surveys. Unpub. Progress Report. U.S. Fish and Wildlife Service, Juneau, AK

HODGES, J. I. AND D. WITMER. 1990. Alaska duck production survey data analysis software. Unpub. Report. U.S. Fish and Wildlife Service, Anchorage AK

LENSINK, C. J. 1962. Waterfowl populations and production within the impoundment area of the proposed dam at Rampart on the Yukon River, Alaska. Unpub. Progress Report. Bureau of Sport Fisheries and Wildlife, Laurel, MD.

————. 1965. Waterfowl and waterfowl habitats of the Yukon Flats. Unpub. Draft Report. Bureau of Sport Fisheries and Wildlife, Bethel, AK

LENSINK, C. J. AND T. C. ROTHE. 1986. Value of Alaskan wetlands for waterfowl. Unpub. Report. U.S. Fish and Wildlife Service, Anchorage, AK

U.S. Fish and Wildlife Service, 1964. A report on fish and wildlife resources affected by Rampart Canyon dam and reservoir project, Yukon River, Alaska. Unpub. Report. U.S. Fish and Wildlife Service, Juneau, AK

————. 1983 - 1986. Yukon Flats National Wildlife Refuge Annual Narrative Reports. Unpub. Report. U.S. Fish and Wildlife Service, Anchorage, AK

————. 1987. Yukon Flats National Wildlife Refuge final comprehensive conservation plan, environmental impact statement, and wilderness review. U.S. Fish and Wildlife Service, Anchorage, AK

————. 1990. Revision of Duck Production Survey Program Draft Duck Production Survey Standard Operating Procedures Manual. Memorandum. U.S. Fish and Wildlife Service, Anchorage, AK

————. 1991. Standard Operating Procedures for the Duck Production Survey. Memorandum. U.S. Fish and Wildlife Service, Anchorage, AK

————, Bureau of Land Management, National Park Service, USDA Forest Service. 1990. Alaska Submerged Lands Act Report - Analysis of inholdings, acquisition priorities and recommendations to reduce impacts on conservation system units in Alaska. U.S. Govt. Printing Office, Washington, D.C.

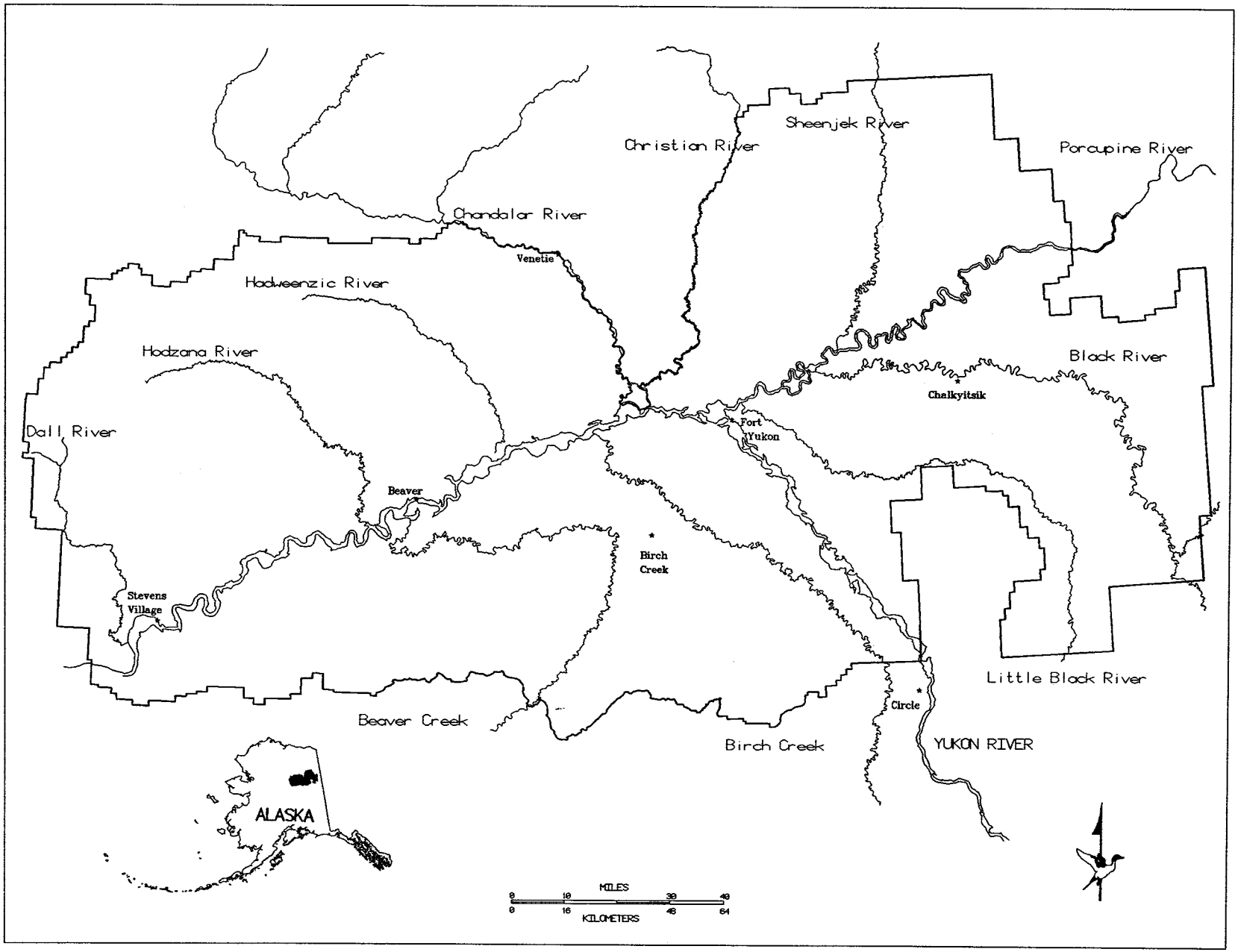

Fig. 1. Yukon Flats National Wildlife Refuge boundary, villages and major rivers.